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ABSTRACT

The study compares the content retention by students who are self-paced with content retention by students whose pacing is modified by instructors. The subjects included 148 students enrolled in an introductory college level child development course. One group of 74 students was randomly assigned to a self-paced section and another group of 74 students was assigned to an instructor-paced group. The general procedure was to divide course materials into 15 units of approximately equal size. At the completion of each unit's assignment, students were required to pass a 10-item, short answer essay quiz and an oral examination. Ninety percent mastery was required. The course syllabi for the two groups were identical except for the section describing grading procedures. In the self-paced group, students were permitted to complete the course at their own rate within the semester. The final grade was based solely on the number of units mastered. Findings indicated that even though the self-paced group procrastinated while the instructor-paced group worked at an even rate throughout the semester, both groups scored similarly on pre-, post-, and follow-up tests and were equally satisfied with the course. No differences were found in the number of units completed, final grade distribution, or course withdrawal rates. (Author/DB)

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Self-Pacing versus Pacing Requirements: Criterion Measures, Student Evaluations, and Retention

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Abstract

One concern of instructors using the personalized system of instruction (PSI) is student procrastination. This study compared progress through course work with student achievement, course evaluation, and content retention under two conditions: student self-pacing and a modified instructor-paced point system. One hundred and forty eight students, divided by class into the two conditions, worked through fifteen units of course material. Results showed that even though the self-paced group procrastinated while the instructor-paced group worked at an even rate throughout the semester, both groups scored similarly on pre-, post-, and follow-up tests and were equally satisfied with the course. Moreover, no differences were found in the number of units completed, final grade distributions, or course withdrawal rates. The withdrawal rate data and the tendency for the self-paced group to score better on the follow-up test were discussed in terms of course management.

Self-versus Instructor-Pacing:
Achievement, Evaluations and Retention[1]

For educators and students alike, the self-pacing component of personalized systems of instruction (PSI) has traditionally been one of its most popular features (Carroll, 1963; Keller, 1968; Kulik, Kulik, & Charmichael, 1974; Lloyd, 1975; Sherman, 1974; Whitehurst & Whitehurst, 1975). Self-pacing allows students to work at their own rate and plan for competing assignments from other courses; and in the end, it promotes uniform subject mastery on the part of each student.

Recent research, however, indicates that self-pacing may not be one of the necessary conditions outlined by Keller (1968) that promotes effective learning (Bijou, Morris, & Parsons, 1976; Bitgood & Segrave, 1974; Burt, 1974; Lloyd, 1971; Lloyd & Knutzen, 1969; Mawhinney, et al., 1971; Miller, Weaver, & Semb, 1974; Semb, Spencer, Conyers & Sosa, 1974; Sutterer & Holloway, 1974). Compared with the lecture method, PSI courses typically have higher rates of student withdrawal (Born, Davis, Whelan & Jackson, 1972; Born, Gledhill, & Davis, 1972; Born & Whelan, 1973; Burt, 1973; Keller, 1968; Kulik, et al., 1974; McMichael & Corey 1968; Philippas & Sommerfeldt, 1972; Sheppard & MacDermot, 1970). And even within PSI courses themselves, students who are permitted to self-pace are more likely to withdraw than those who are under instructor-paced contingencies (Semb, et al., 1974). Moreover, in self-paced PSI courses, rates of taking tests decline over a semester until students "cram" towards the end (Atkins & Lockhart, 1976; Burt, 1974; Lloyd & Knutzen, 1960; Lloyd, McMullin, & Fox, in press; Mawhinney, et al., 1971),

undergraduate teaching assistants are inefficiently used, study centers become overcrowded, and mastery criteria sometimes deteriorate (Semb, et al., 1974; Sutterer & Holloway, 1974).

To counteract these problems, some instructors have implemented required instructor-paced schedules for student progress (Lloyd, 1971; Malott & Svinicki, 1969; Miller, Weaver, & Semb, 1974; Stalling, 1974; Sutterer & Holloway, 1974), while others have introduced more flexible combinations of instructor- and student-paced point systems (Bijou, et al., 1976; Bitgood & Segrave, 1974; Burt, 1975; Powers, Edwards, & Hoehle, 1973; Semb, et al., 1974). Both types of pacing systems have been found effective in reducing student procrastination and withdrawal (Semb, et al., 1974), but only a few studies have compared self-pacing to instructor-pacing in terms of student achievement. The available data indicate that neither learning (Atkins & Lockhart, 1976; Bitgood & Segrave, 1974; Burt, 1976; Lloyd, et al., in press; Semb, et al., 1974) nor course satisfaction (Bitgood & Segrave, 1974; Semb, et al., 1974) is affected by whether students self-pace or meet an instructor's pacing requirements. Given that there are no differences, the logistics of teaching assistant workloads and efficient, effective student management favor the use of instructor-paced teaching systems.

Despite this equivalence of final examination scores and course evaluations, little is known about retention of material following course completion. A few studies have shown that students learning under a PSI system retained knowledge repertoires better than those learning under a lecture-discussion format (Cole, Martin, & Vincent, 1974; Cooper

& Greiner, 1971; Corey & McMichael, 1974; Moore, Hauck, & Gagne, 1973), but these differences may reflect differential content acquisition more than they do differential retention per se (Lloyd, 1960, 1975).

As far as we know, no research has been reported that compares the content retention by students whose pacing is evenly regulated by pacing contingencies with content retention by students who self-pace. Therefore, this study was designed both to replicate research comparing self-paced to flexible instructor-paced approaches, and to extend the findings to follow-up assessment of content retention.

Method

Subjects

One hundred and forty-eight students were enrolled in a PSI section of an introductory child development course. Equal numbers of freshmen, sophomores, juniors, and seniors were randomly assigned to the self-paced and instructor-paced groups.

General Procedures[2]

Course materials[3] were divided into 15 units of approximately equal size, one for each week of the semester. At the completion of each unit's assignment, students came individually to a study center where they were required to pass a ten-item, short answer essay quiz and an oral examination; both were graded by undergraduate teaching assistants. Ninety percent mastery was required. If one question were missed, it was included on the quiz for the next unit; if more than one question were missed, a make-up quiz was required.

Experimental Manipulations

The course syllabi given to the students in the self-paced and instructor-paced groups were identical except for the section describing grading procedures.

Self-paced condition. Students assigned to the self-paced group were permitted to complete the course at their own rate within the semester's time. A student's final grade was based solely on the number of units mastered: 15 units = A, 14 units = B, 13 units = C, and 12 units or less = F.

Instructor-paced condition. Students assigned to the instructor-paced group worked within a flexible point system. As with students in the self-paced group, they could proceed as quickly as they desired and the number of units completed had the same relationship to their final grade. However, these students also had to meet a point criterion: they had to master at least one unit of material each week. Failure to meet this criterion resulted in a one-letter drop in grade (i.e., from A to B, B to C, etc.).

Completing each unit by the Thursday or Friday of its respective week earned the students enough points to meet the point criterion; however, the system was flexible in that more points could be earned for passing unit quizzes earlier in a week (see Table 1). Thus, the student who

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Insert Table 1 about here

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fell behind had some opportunity to make up points by mastering subsequent

units on Mondays, Tuesdays, or Wednesdays of the following weeks. If a student failed to acquire the requisite number of points, the grade could still be maintained by completing a term paper of A quality with one opportunity for a revision.

Achievement Measures

The primary achievement measure was student performance on a 53-item multiple-choice test. Three or four items from all but the first unit were included and randomly ordered. Because the weekly unit quiz was of the short answer, essay variety, none of the questions on the criterion test was the same even though the material covered was identical.

The multiple-choice test was administered as a pre-test during the students' first visit to the study center when they turned in their unit one quiz, a take-home. A re-randomized posttest was administered immediately after each student's completion of the last unit of the course. The students were informed each time that their performance on the test would not affect their final grade.

A course evaluation questionnaire was also administered upon completion of the course. Questions were designed to cover the students' (1) satisfaction with the course organization, the quizzes and grading procedures, the teaching assistant and the oral quizzes, the one-hour optional weekly lectures, and (2) general reactions to the course.

Nine months following completion of the semester, all students were contacted by mail and offered $2.00 to take a follow-up test on which the same items were again re-randomized. In addition to this monetary inducement, when they arrived the students were informed that they could earn an extra 2¢ for each question answered correctly.

Results

Of the 148 students originally enrolled in the course, 127 received final grades at the end of the semester. Three students had to be given incompletes for medical excuses, while 16 dropped the course. However, there was no difference in course withdrawal rate between the self-paced and instructor-paced groups as both lost eight students each (10.8%). Nor were there any differences in the final grade distributions; over 90% of the students in both groups recieved A's. Finally, the two groups performed almost identically on the 53 item pretest. The mean number of correct items for the self-paced group was 20.5, and 20.3 for the instructor-paced group.

Pacing

Figure 1 presents the cumulative number of units completed by the two groups over course days. These data indicated that the self-paced group lagged behind the instructor-paced group for most of the semester and then accelerated its work output in the final two weeks. By the end

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Insert Fig. 1 about here

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of the course, the average number of units completed by each group was the same: self-paced group = 14.77 and instructor-paced group = 14.95.

However, there was a statistically significant difference between the two groups in terms of the number of quizzes repeated throughout the semester. Students in the self-paced group had to repeat 4.1% of their quizzes, whereas those in the instructor-paced group had to repeat 7.2% of theirs ($X^2 = 8.75$, $df = 1$, $p < .01$).

Posttest Achievement Measure

The mean scores on the posttest were 32.6 for the self-paced group and 32.2 for the instructor-paced group. When compared with the pretest scores, an analysis of variance showed that the main effect of the pre-/posttest was significant ($F = 412.9$, $df = 1/124$, $p < .001$), while neither the main effect of the treatment (experimental conditions) nor the treatment by pre-/posttest interaction approached significance. The performances of the two groups on the multiple-choice criterion tests increased significantly from the pretest to the posttest, but the two groups did not differ in their scores on either. In other words, it made no difference whether the students self-paced and procrastinated or whether they worked at an even rate under point incentives; they scored identically on the posttest achievement measure.

Course Evaluations

The course evaluation questionnaires completed at the end of the course yielded no differences on the satisfaction ratings in any of the five dimensions evaluated: organization, quizzing, proctors, lectures, and general reactions. Both groups were equally positive about the course as all ratings ranged from 2.90 and 3.45 on a four point scale.

Retention Achievement Measures

Data were collected on 51 (40.2%) of the 127 students who received final grades in the course, 27 (42.9%) from the self-paced group and 24 (37.5%) from the instructor-paced group. Figure 2 shows the retention test scores for these samples along with their pre- and posttest scores.

Insert Fig. 2 about here

The pre- and posttest scores of these follow-up students were similar to

those of their groups as a whole. Moreover, the final grade distributions of the two follow-up groups also matched those of their respective groups.

Analysis of variance indicated a strong test (pre-, post-, retention) main effect ($F = 114.9$, $df = 2,98$, $p < .001$) and that the group x text interaction was not statistically significant ($F = 2.42$, $df = 2,98$). However, p value for the group x test interaction was 0.094 and suggested that the self-paced group performed somewhat better on the retention test than did the instructor-paced students.

Discussion

A comparison between a student self-paced instruction system and a flexible, isntructor-paced point system revealed that students procrastinated when they "self-paced," yet proceeded evenly through course material when given incentives to do so. As noted elsewhere, students don't self-pace; they pace according to the conditions that control the pacing behavior (Bijou, et al., 1976). In most cases when we say a student self-paces, we are admitting that we do not know what the conditions are that produce pacing. These results are also in agreement with other research demonstrating that whether students self-pace or have their pacing regulated, they score similarly on criterion measures of course achievement (Atkins & Lockhart, 1976; Bitgood & Segrave, 1974; Burt, 1974; Lloyd, et al., in press; Semb, et al., 1974) and are highly and equally satisfied with the ways in which they were instructed (Bitgood & Segrave, 1974; Semb, et al., 1974).

In addition to the similarity of course achievement and course satisfaction measures, the two groups showed no differences in (1) the number of units completed, (2) final grade distributions, or (3) course

withdrawal rates. However, the self-paced group did have to repeat fewer quizzes, and this would seem to be to the students' advantage. Why this difference occurred is not immediately apparent, but it could be that they took quizzes when they were prepared to rather than being forced to at the end of a week, prepared or not.

The data on course withdrawal are particularly interesting. As mentioned earlier, PSI courses generally have higher withdrawal rates than lecture-discussion courses and the presumption often is that the self-pacing feature is the culprit, yet there is only meager empirical substantiation for this claim (see Semb, et al., 1974). On the other hand, findings from this study indicate that the self-pacing component of the PSI course had no differential effect on student withdrawal. Certainly, the matter is not settled and the wide procedural variations from one PSI course to the next preclude a final answer. But the point can be made that self-pacing need not lead to greater student withdrawal. When it does, the other components of the PSI package should be scrutinized; these other factors may be interacting with the self-pacing component thereby inducing high withdrawal rates. The data obtained here suggest this need not occur.

Although the results show striking similarities between the two groups on dependent measures relevant to educational achievement, many educators would still be troubled over student procrastination in the self-paced group. Course management logistics aside, cramming typically has been considered less desirable than regularly paced study; however, there are as yet no supportive data in the PSI literature for this conclusion (Burt, 1975). Therefore, the inclusion of a follow-up retention measure was a logical step for assessing possible differences.

But no statistical retention differences were apparent. If anything, the data suggested that the benefit might go to the procrastinating self-paced group. Maybe the educators and students were right after all about self-pacing being an important aspect of the PSI system.

In addition to this retention trend, the difference between the two groups in quiz repeat rates was in favor of the self-paced group; they failed significantly fewer quizzes. But when all other achievement measures are the same, it is difficult to know how to interpret a high or low repeat rate. One conclusion is that more students in the instructor-paced group took quizzes before they were adequately prepared. However, the supposedly aversive event of quiz failure did not seem to influence the course evaluation measures. On the other hand, it might be suggested that we are not measuring the appropriate behaviors. Perhaps instructor-pacing and the quiz repeats are teaching students something else, something unrelated to achievement. Perhaps they are teaching pacing skills that will be more important to future learning than the content of any single course.

Future PSI research should attempt to determine whether pacing skills, once acquired in a course, will then be applied in subsequent courses. However, a caveat needs to be entered. Analogous to the difficulties of generalization from clinical and educational programs, pacing skills should not be expected to appear magically in other learning settings. They must be programmed and planned for. Perhaps instructor-paced systems would be part of the program, perhaps not. But we should begin to find out. If instructor-paced systems are not part of a learning-to-self-pace program, then we must examine the possible benefits of self-paced systems for content retention despite the course management problems they generate.

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Footnotes

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2. See Bijou, Morris, and Parsons (1976) for a more detailed description of course management procedures, especially in regard to the pacing system.

3. Course materials included Child development: The basic stage of early childhood (Bijou, 1976); Child development I: A systematic and empirical theory (Bijou & Baer, 1961); Child development II: Universal stage of infancy (Bijou & Baer, 1965); Child development: Readings in experimental analysis (Bijou & Baer, 1967); and Course guide (Bijou, 1973, unpublished).

Table 1

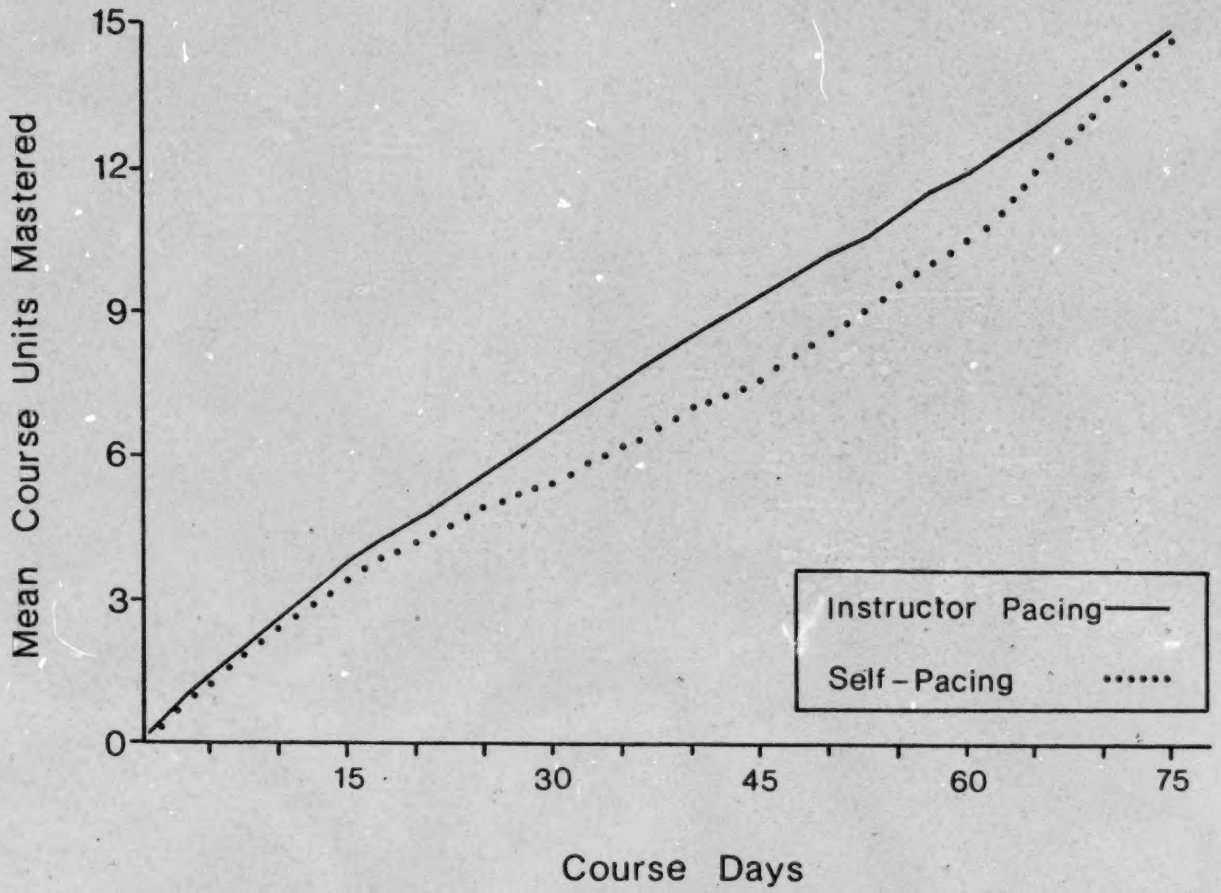
Instructor-Pacing Point Schedule

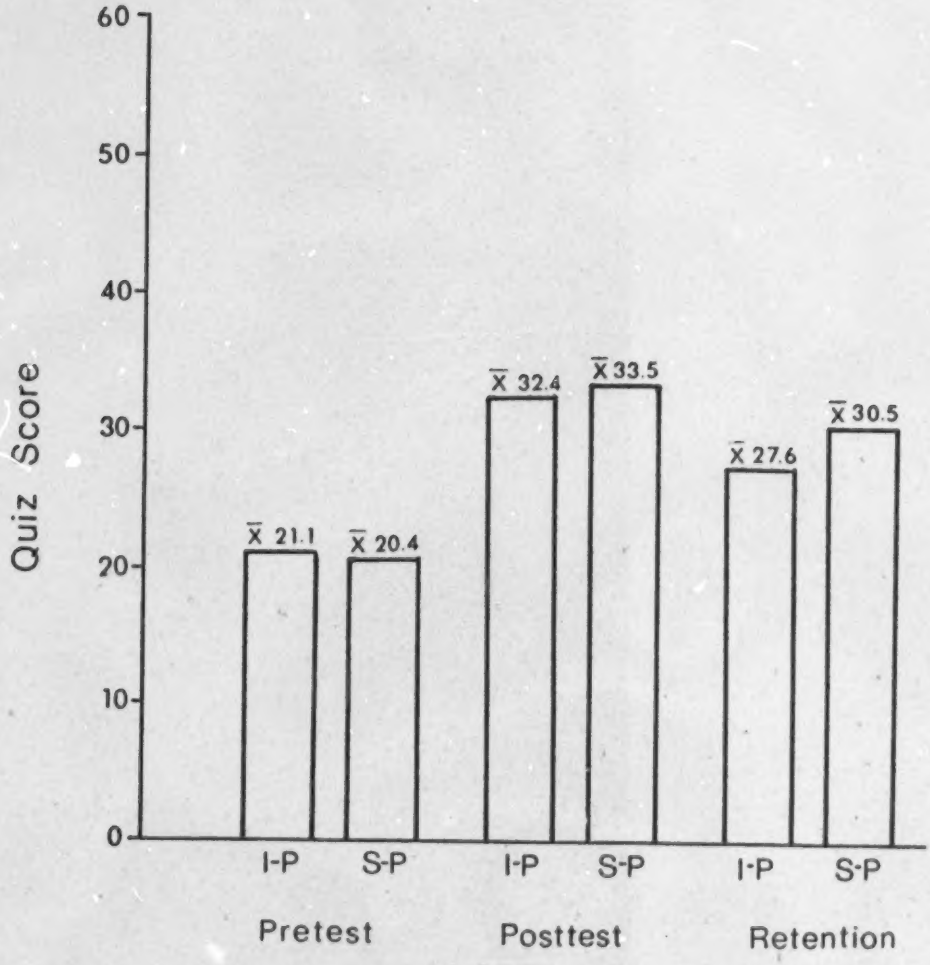
Day of Week	Mon	Tues	Wed	Thurs	Fri
Points for quiz X in week X	10	10	9	8	8
Points for quiz X in week X + 1	5	-	-	-	-

Figure Captions

Figure 1. Cumulative mean number of course units mastered over course days by the self-paced and instructor-paced groups.

Figure 2. Pretest, posttest, and retention achievement scores for the follow-up samples from the self-paced (S-P) and instructor-paced (I-P) groups.


Mean Course Units Mastered
15
12
9
6
3
0
15
30
45
60
75
Course Days
Instructor Pacing
Self-Pacing


Quiz Score
60
50
40
30
20
10
0
X̄ 21.1
X̄ 20.4
X̄ 32.4
X̄ 33.5
X̄ 27.6
X̄ 30.5
I-P
S-P
I-P
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I-P
S-P
Pretest
Posttest
Retention